United States Department of Agriculture

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

New Pest Response Guidelines

ASIAN LONGHORNED BEETLE
Anoplophora glabripennis

Prepared by: Invasive Species and Pest Management Staff

Date: Revised April 2000

INDEX

PURPOSE

This New Pest Response Guideline provides guidelines and actions for an Asian Longhorned Beetle *Anoplophora glabripennis* (Motschulsky) eradication program.

It is intended for use as a guide, when an outbreak of Asian Longhorned Beetle (ALB) is known to exist. The procedures described in this New Pest Response Guideline were developed by consulting with APHIS-PPQ and State Plant Regulatory Officials directly involved in ALB eradication.

DISCLAIMER

This document is not intended to be complete and exhaustive. The information given herein was taken from consultation with ALB program managers, some of the available literature and synthesized into a specialized paper intended to assist further work, as given above.

I. GENERAL INFORMATION

A. Action Statement

The information contained in this document is intended for use when an outbreak of Asian Longhorned Beetle (ALB) is known to exist. This action plan is to be used for guidance in implementing eradication procedures and in preventing the spread of the insect to other locations. This document provides the technical and general information needed to implement any phase of an Asian Longhorned Beetle eradication program. The specific emergency program is to be based on information available at the time the outbreak is detected.

B. Background Information

The Asian Longhorned Beetle *Anoplophora glabripennis* (Motschulsky) is native to Asia. It occurs in China, Japan, and Korea (Peng & Liu 1992). Eradication programs are being conducted in New York, Chicago and Great Britain. ALB feeds on a wide variety of tree species. (See Appendix 1.)

In the Brooklyn, NY infestation, the mature ALB larvae feed in the heartwood of mature street and park trees (primarily maple and horse chestnut). Adults emerge during the summer months through 3/8 inch diameter holes in the bark. Heavy sap flow occurs from these large tree, trunk, and branch wounds. Infested trees are also prone to secondary attack by other diseases or insects. Heavy sawdust debris is found at the base of afflicted trees. Oviposition cavities chewed out by females are found in the tree bark, and the junction of branches and the trunk (NPAG 1996).

C. Life Cycle

A typical life cycle for this pest is:

Egg-->Larva-->Pupa-->Adult

Egg Stage: The off white oblong eggs are 5-7 mm in length. Both ends are slightly concave (Peng & Liu, 1992).

Larval Stage: Mature larvae are 50 mm in length. The prothrax has a brownmark. The front of the mark does not have a brown margin (Peng & Liu, 1992).

Pupal Stage: The off-white pupae are 30 - 33 mm in length with a width of 11 mm. The eighth segment of the abdomen has a protruding structure (Peng & Liu, 1992).

Adult Stage: Adults are 20-35 mm in length and 7-12 mm in width. Their color is jet black with a luster. The antennae have 11 segments.The base of the antennae are whitish with a blue-black color. The antenna of the males are 2.5 times their body length; the antenna of the females are 1.3 times the body length. The base of the elytra does not have a granular structure. Each elytron has about 20 white dots (Peng & Liu, 1992).

ALB can overwinter as an egg, as a larva developed within an egg, as a larva, or as a pupa. The first three instars feed in the phoelm and the late third and early fourth instars move into the xylem. Adult emergence begins in May and peak populations occur in early July. Females live 14-66 days, males live 3-50 days. Females lay eggs and larvae thrive on healthy or stressed host trees of all ages, and on recently cut logs. Adults tend to lay eggs on the same part of a tree, year after year, until that part dies.

I.I ORGANIZATION, RESPONSIBILITIES AND STAFFING

At the outset of the project, the PPQ State Plant Health Director, in consultation with the State Plant Regulatory Official will select the project leader. The project leader will organize the management structure, act as liaison with cooperators, develop personnel rotational schedules, identify preliminary administrative and technical support needs. The project leader reviews, evaluates and adjusts program functions in progress.

If the size of the project warrants, the project leader may designate any number of assistant project leaders to organize and implement duties in the areas of administrative support, survey, regulatory activities, and public outreach/media information. The duties are summarized below under individual headings. Each assistant project leader will report directly to the project leader.

PPQ personnel will first be enlisted from within the affected region. If the project progresses in scope beyond regional personnel availability, additional staffing will be drawn from the Rapid Response Teams of the other regions.

TDY assignments will be for a minimum of thirty (30) days. Rotational assignments will allow for a one week overlap so that a training period of three working days is provided for the orderly transfer of duty assignments. Replacement personnel will be trained by theindividual replaced.

Job announcements for full time PPQ positions to manage and staff the ALB project should be announced no later than 60 days after the project begins.

B. Project Leader

1. Establishes a base of operations.
2. Organizes a management structure
3. Establishes operational protocol.

4. Arranges for notification of affected individuals, agencies or groups
5. Ensures appropriate public notification.
6. Authorizes mobilization of emergency equipment and supply inventory.
7. Identifies preliminary technical support needs.
8. Maintains chronology of program activities.
9. Provides daily information reporting system.
10. Provides information on the preparation of budgets.
11. Provide periodic and final project reports to technical advisory representatives.
12. Establishes a computerized data processing center for timely output of information for items 8-11
13. Obtains regular timely reports and supervises all assistant project leaders.

B. Administrative Support

A full-time administrative officer should be assigned to the program from its inception. This individual will need to be on-site during program startup to facilitate the following activities.

1. Arrange for facilities, office space and furniture.
2. Furnishes equipment, telephone, data processing, word processing and other communication devices.
3. Arranges for vehicles, vehicle maintenance, and vehicle safety training.
4. Establishes and maintains inventory of administrative supplies manuals and forms.
5. Ensures appropriate hiring practices and paperwork.
6. Processes request for travel advances, purchase orders, invoice vouchers, travel claims, and other obligating documents.
7. Initiates contracts and cooperative agreements.
8. Maintains a record of expenditures.
9. Maintains vehicle inventory and records.
10. Develops and maintains a system for providing badges and identification.
11. Maintains time and attendance records for seasonal and permanent employees.
12. Arranges hotel reservations and travel.
13. Establishes a protocol for processing damage claims

C. Survey

1. Initiates and implements the survey program.
2. Arranges for personnel, equipment, and vehicles. This includes scheduling the use of Bucket Trucks and Tree Climbers.
3. Maintains survey supplies.
4. Arranges for prompt specimen identification.
5. Provides shipment protocol and handling safeguards for specimens.
6. Establishes a quality control program for survey activities.
7. Reports positive ALB finds to the project leader.

8. Maintains maps and complete records of all positive ALB finds.
9. Ensures the quality of all electronic data for the project.

D. Regulatory

1. Coordinates regulatory activities with all cooperating parties.
2. Ensures that all property owners are notified prior to the removal of ALB positive host material.
3. Coordinates the proposed quarantine boundaries with the appropriate state and federal cooperators.
4. Notifies the affected industries, and others of regulated items.
5. Makes available approved regulatory treatment procedures to all concerned groups.
6. Implements a regulatory quality control program to insure that all contractors are removing ALB positive host material in accordance with existing contracts.
7. Provides for continuing regulatory action as needed.

E. Public Outreach and Media Relations

1. Prepares press releases for distribution to the media, including foreign language releases as necessary.*
2. Makes progress reports to the local media.*
3. Acts as media liaison.*
4. Provides stock footage, prints graphics and other displays.*
5. Arranges interviews.*
6. Arranges meetings with the general public.
7. Prepares and arranges mailings to the general public.
8. Cooperates with regulatory personnel to provide clearly written treatment handouts.
9. Identifies special interest groups, such as affected industries, local clubs, and environmental groups and conducts presentations.
10. Coordinates community panel meetings, as necessary.

* Cooridinated with APHIS/LPA

III. SURVEY PROCEDURES

When one or more ALB are collected in an area, the survey procedures listed below will be implemented. The host tree identified as infested will serve as the epicenter. All survey protocols will originate from that point.

A. Intensive Core Survey

Annually, all host trees within a ½ mile radius of the initial find are surveyed visually. The initial survey is conducted by ground crews. Once visible damage is no longer evident from the ground, Bucket Trucks and Tree Climbers are used to complete the survey within the ½ mile

radius. It is recommended that Bucket Trucks be used to survey street/curbside trees and Tree Climbers for trees on private property. If additional infestations are found, the ½ mile core area will be extended from the outer most find.

B. Delimiting Survey

A minimum of a 1-mile beyond the Intensive Core Survey Boundary is surveyed. All street/curbside host trees are surveyed using Bucket Trucks and ground crews. In residential areas, a minimum of four private properties with host trees per block are surveyed initially using Tree Climbers and ground crews. Annually, all host trees in the delimiting area are surveyed using ground crews, Bucket Trucks or Tree Climbers.

C. High Risk Site Detection Survey

Use investigative work to identify potential high risk sites where ALB infested materials may have been taken. Utilize interviews, databases, yellow pages, ads or other potentially valuable sources of information to identify the following:

1. Tree services that conduct business within the infested or regulated area. Find locations where their vehicles are routinely parked, wood is disposed of or stored.
2. Municipal parks, tree wardens, foresters or other municipal groups that may cut or trim trees.
3. In heavily infested areas, query local residents about any firewood they may have cut and given away or transported to other locations (cabins, camps, etc.).
4. Landfills or other places used for the disposal of recently cut wood and brush.
5. Utility companies.
6. Anyone else who may cut and transport wood.

At sites identified above conduct annual ground based visual surveys of 50 to 100 potential host trees surrounding the site for ALB. Managers may choose to use Bucket Trucks and Tree Climbers based on the availability of resources. Only include trees that are within 1.25 miles of the site.

If ALB is found then the Intensive Core and Delimiting Survey Protocols will be used to determine the extent of the infestation.

D. Area Wide Detection Survey

All one square mile areas within 25 miles of the epicenter of the current ALB infestation and outside of the regulated area, shall be surveyed at least once every three years in the following manner. Two host trees at each of nine sites per square mile shall be inspected visually from the ground for evidence of ALB infestation. Sites shall be well distributed throughout the square mile block and separated by a minimum of 300 meters. Use a GPS unit (if available) to document locations and other data (see Survey Records page 7). It is convenient to use

Township-Range-Section where available to define survey blocks. The first area wide survey should be completed within one year of discovering a new infestation that is not associated with the existing regulated areas for ALB.

E. General Survey Information

The following information applies to all of the surveys listed above.

1. Survey crews must be able to recognize ALB host trees from ground level. It may be necessary for the PPQ Regional Botanist or other qualified individual to provide this training prior to starting survey activities. ALB host trees are listed in Appendix 1.
2. Bucket Trucks require trained operators to function safely. Initially qualified survey crew members will have to accompany these operators to show them the ALB damage the cooperative program is looking for.
3. Tree Climbers are available from the United States Forest Service.
4. Tree Climbers are more effective than Bucket Trucks when leaves are on the trees.
5. Trees in excess of 28 inches in diameter at breast height (DBH) may require two Tree Climbers to conduct biologically sound surveys in a timely manner.
6. All surveys will be augmented with strong local media and public information campaigns

F. Quality Control

For delimiting and high risk site detection surveys, supervisors should ensure that survey crews are routinely challenged with simulated ALB damage, such as false exit holes, or pits chipped into the bark (false oviposition sites). Field or lab-collected frass may also be used. These techniques should not be used on a regular schedule and simulated damage should not be restricted to a specific portion of trees. Location and timing of simulated damage must be carefully documented when it is put into place. The survey crew should be informed that this type of Quality Control testing will be ongoing, but should not be told where or when it will occur. The GPS data collected during the Area Wide Detection Survey will serve as the quality Control for this survey.

G. Survey Records

Records of all ALB-positive host material will be maintained. These records will include the following:

1. Location of tree, street address or GPS coordinates.
2. Ownership of tree (private or public).
3. If the tree is privately owned, the record will inlcude the property owners name and telephone number.
4. Whether or not the private owner was notified of the results of the survey.
5. Type of host tree.
6. Size of tree to include measured DBH
7. Type of ALB damage found.
8. Date the ALB damage was found.

9. Identifying marks placed on the tree by the survey crew. These can include but are not limited to colored plastic ribbons, spray paint or other easily recognizable means of identification.
10. Type of survey, ground, bucket truck or tree climber.

Records of negative ALB survey for the Intensive Core and Delimiting survey areas will include the following:

1. Date of survey
2. Number and type of host trees surveyed.
3. Location of survey, street address or GPS coordinates.
4. Type of survey, ground bucket truck or tree climber.

High Risk Site Detection Survey data will include the following:

1. Date of survey.
2. Name of business (if applicable).
3. Contact for business, to include name and phone number (if applicable).
4. Location of survey, street address or GPS coordinates.
5. Number and type of host trees surveyed.
6. Type of survey, ground, bucket truck or tree climber.

Area Wide Detection Survey data will include the following:

1. Date of survey.
2. County of survey.
3. Township-Range-Section of survey (if available).
4. Location of survey, street address or GPS coordinates.
5. Number and type of host trees surveyed.

H. Data Entry and Management

All data collected by survey crews and from tree removal activities will be collected daily. The data will be:

1. Checked for accuracy.
2. Be in the correct format.
3. Downloaded from field data collection devices and entered into the ALB database.

The data manager will also be responsible for:

1. Producing maps of regulated areas.
2. Maintaining GPS Units and Data Loggers.

3. Providing reports to the program manager as necessary.
4. Maintaining and updating the ALB database.
5. Keeping accurate statistical records of the number of trees removed, regulated establishments, compliance agreements, permits and other associated paperwork.
6. Analyze data to provide the program manager with information on trends and patterns as they relate to the ALB eradication program.

IV. REGULATORY ACTIVITIES

A. Regulatory Authorities

Federal Quarantines for ALB include 7 CFR 301.51 for eradication programs and 7 CFR 319.40 for solid wood packing material. However, under these regulations, PPQ cannot quarantine a geographical area smaller than an entire state.

As a result, the State Plant Regulatory Agency from the infested state will have to enact an interior state quarantine for ALB to facilitate regulatory activities on a geographical area within the state.

B. Regulated Articles

The regulated articles for ALB include the following:

1. The Asian Longhorned Beetle (*Anoplophora glabripennis)* in any living stage of development.
2. Firewood all hardwood species.
3. All host material living, dead, cut or fallen inclusive of nursery stock, logs, green lumber, stumps, roots, branches, and debris of half inch or more in diameter of the general listed in Appendix 1.

C. Regulated Establishments

Establishments placed under regulations for ALB within a quarantined area include:

1. Landscapers
2. Tree pruning companies
3. Tree removal companies
4. Firewood dealers
5. Pallet distributors
6. Nurseries
7. Sanitation workers, as well as other municipal or community services and associated contractors.

D. Enforcement

Compliance agreements with the regulated establishments listed previously are mandatory. An example of a compliance agreement is contained in Appendix 3. All firewood (of hardwood species), ALB-infested host material and dead cut, or fallen logs, green lumber, stumps, roots, branches, and debris of ½ inch or more in diameter, of regulated species are required to be chipped (no larger than 5/8 inch) prior to leaving the regulated area.

Nursery stock in the regulated area is subject to inspection. Any infested host material found in the nursery trade is required to be chipped. Chipped material must be no larger than 5/8 inch. Unifested host material in the nursery trade is allowed to leave the regulated area if accompanied by a certificate of inspection and the approved permits. When uninfested host material is sold for planting within the regulated area the seller will keep records of the sale. These records will include the name, address, and phone number of the buyer so that regulatory officers can inspect the host material after planting for the presence or absence of ALB.

E. Trace Back Inspections and Trace Forward Inspections

Trace back inspections will be conducted in an attempt to determine the source of the infestation. These inspections will begin at the epicenter of the core area and work outward from there.

Trace forward inspections will be conducted to determine if infested host material has been moved out of the regulated area. These inspections will start with the regulated establishments located in and/or conducting business within the regulated area. Once these establishments are identified the survey protocols used for the High Risk Establishment survey will apply.

F. Quarantine Boundaries

Initial quarantine boundaries are established through consultation with the cooperating regulatory agencies on the project. Generally these boundaries are set using the delimiting protocols mentioned in the survey section of this document, in conjunction with existing geographical barriers.

Hot spot infestations are those areas which contain ALB-infested host material that can be directly linked to the movement of regulated articles outside of an existing quarantined area. These infestations are identified through the High Risk Site Survey protocols or Trace Forward Inspections. They are characterized by their small size, (all infested trees are contained within a a 300-yard radius). With the consensus of the cooperating regulatory agencies on the project, these areas can be placed under a transitional quarantine boundary of 1/2 mile in radius. These areas will be monitored throughout the year, using intensive core area and delimiting survey methods. If spread beyond 1/2 mile is identified, then the standard quarantine boundary protocols will be applied.

G. Quality Control

Regulatory Officers will spot check the removal of ALB-positive host material to ensure that contractual obligations are being met.

H. Tree Replacement and Restoration

The United States Forest Service (USFS) is the lead federal agency for this portion of the ALB eradication program. They provide funding to local cooperators to implement tree replanting and restoration efforts within regulated areas. To coordinate this effort, please contact the local USFS office.

V CONTROL

The control strategy provides a means to significantly reduce ALB populations by targeting the area into which the pest is most likely to naturally disperse from an outbreak site. When combined with intensive detection activities, the strategy is expected to eradicate the pest from the outbreak site within 3 to 5 years.

A. Strategy

Infested trees: Remove ALB infested host material. Presence of oviposition sites or exit holes indicates infestation.

Control zone: Remove or chemically treat all ALB host material within a minimum 1/8 mile radius of infested hosts.

Hosts: For control purposes, hosts are genera and species identified in Appendix 1 of this document as having a high or medium host rating for ALB. This includes *Acer spp., Aesculus spp., Albizia julibrissan, Betula spp, Elaeagnus augustifolia, Fraxinus, spp., Populus spp., Salix spp., and Ulmus spp. Hibiscus syriacus* (Rose of Sharon) as a host for control activities is an exception. Feeding damage and egg laying sites (no exit holes) have only been observed on this host at one site in Amityville, NY.

Rationale for minimum radius:

- estimated distance of natural spread/year:
  a) China: maximum distance in mark recapture study - 4600 ft in 3 weeks,
  b) Chicago: 2 years data; measured distance from 666 trees with oviposition sites only to the nearest tree with exit hole: 80% of trees with oviposition site only are within 330 ft (1/16 mile) of a tree with an exit hole; 94% within 660 ft (1/8 mile); 99% within 1320 ft (1/4 mile); 99.7% within 1980 ft (3/8 mile); Trees with both oviposition sites and exit holes are excluded from the analysis.
- flight ability: China: maximum distance of single observed flight - 1200 ft.

Managers may conduct control activities beyond the minimum depending upon the detection data and the degree of infestation. For example, where there is a large established core with several satellite detections beyond the minimum radius, a manager may want to conduct control activities in the area between the core and the satellite detections.

Any decision to reduce the scope of control actions will be made in consultation with the project director and cooperators.

The decision between removing or chemically treating host trees depends upon specific characteristics of the site or area. On site managers in conjunction with the program director and cooperators will determine the most appropriate activity based on social, biological, environmental, and economic concerns.

Considerations:

- Total host removal and/or chemical treatment within a 1/8 mile radius would encompass an area where a large percentage of the beetles would disperse, but a low % will likely disperse beyond this distance. An effective detection program is essential both inside and outside the control zone.
- Host removal removes immature life stages eliminating potential adult beetle dispersal. Host removal is recommended in near proximity of an infested tree because of the likelihood of infestation.
- Removal during adult emergence and flight season may result in adults dispersing during the process. A bark spray prior to removal is warranted where public and/or environmental health would not be impacted.
- Chemical treatment will likely need to be applied or remain active through two or three emergence seasons to be effective. Chemical treatment is expected to remove a high percentage of emerging adults as they feed on twigs prior to mating and dispersal. Also, dispersing mated female adults would be susceptible to treated trees as they prepare oviposition sites.
- When using chemical treatments, managers should expect to continue to discover exit holes and/or oviposition sites on treated trees. The chemical treatment is not believed to be effective against large larvae already present in the tree at the time of treatment. Also, some holes /sites may not have been discovered during previous surveys. These newly discovered trees with exit holes and/or oviposition sites should be removed and the control zone be adjusted accordingly. Because of this possibility, tree owners should be informed that their chemically treated tree is less likely to become infested but that the tree may have to be removed in the future if evidence of the beetle's presence is discovered.
- The cost of removing and replanting a fixed number of trees may equal or exceed chemically treating the same number of trees over a three year period.

B. Host material removal:

It is recommended that infested host material removal occur within 3 days of detection when beetles are active. During adult emergence and flight season, a bark spray to the infested host material prior to removal is recommended to prevent dispersal of any adult beetles from the host. However, environmental and public concerns must be considered in any decision to use bark sprays

It is recommended that the roots of host material be removed to a minimum of 9 inches below ground level. Any above ground roots of half inch or more in diameter should also be removed.

Host material should be chipped or burned. Chipped material must be no larger than 5/8 inch. Host material that is not chipped may be moved to an approved burning site with proper safeguards: vehicles must be tarped or covered to prevent spillage, an emergency spill plan with contact numbers must be carried by the driver with contact numbers, and host material may be held no longer than 24 hours at the burn site prior to burning.

C. Chemical control:

All pesticides should be used according to their label instructions.

1. Soil or trunk injection:

Chemical: Merit 75WP and Imicide (Active ingredient: Imidacloprid)

Imidacloprid is active against adult ALB as it feeds on small twigs, the female when depositing eggs, and young larvae. Once in the tree, there have been reports of two years control of target pests. Studies are in progress to determine the long term effectiveness of a single application.

Merit 75 WP is registered for use as a soil treatment. Imicide is registered for use in ready to use capsules for trunk injection with the Mauget Micro-injection technology. The contractor and Contracting Officer's Representative (COR) must have the pesticide label and the 2EE label at all times during treatment. Label instructions for application must be strictly adhered to as well as all environmental and safety requirements. Proper spill cleanup material must be on site at all times.

Application timing: Treatments should be made at the time of year to be most effective during the ALB emergence and flight period. For example, in northern areas of the country such as Chicago and New York City, treatments should be made in March/April or September/October.

Sources:

Merit 75WP: Bayer Chemical company. Contact 816-242-4792 for a list of distributors.

Imicide capsules: J.J. Mauget Company, 5435 Peck Rd., Arcadia, CA. 91006-5487 Contact 877 873 3457.

Definition: Diameter at Breast Height (d.b.h.)
For trees, the d.b.h. (4.5 feet above ground level) is used to estimate the amount of material needed for treatment. For multi-stem trees, such as crape myrtle or birches, the rate should be determined on cumulative stem diameter for all stems in the clump.

D.b.h. can be determined by using a specially designed measuring tape or tree caliper which measures tree diameter. Both the tape and caliper can be obtained from tree and nursery suppliers. If these tools are not available, an ordinary tape measure can be used to determine the tree trunk circumference at breast height. Once the circumference is known, the following equation can be used to calculate d.b.h.

Circumference (inches) x 0.32 = d.b.h. (inches)

Example: Tree circumference is 16 inches
16 inches x 0.32 = 5.1 or approximately 5 inches d.b.h.

Treatment options:

a. Soil injection: With Merit 75 WP use 1.89 grams of formulation in 2.0 quarts of water per inch of tree d.b.h., or mix 13.32 ounces of formulation into 100 gallons of water and treat with 2.0 quarts of this formulation per inch of d.b.h. The mix should be agitated before starting the application and periodically during application. Do not mix more than you are going to use during any one treatment day.

   Equipment: Apply the material with a power soil injector capable of a range of 75 to 150 psi at the pump with a standard soil-injector needle. Applicators must be capable of accurately applying two quarts of formulation. Preferred flow rate is a minimum of two gallons per minute.

   Soil injection technique: Merit performs best when placed precisely in contact with fine roots. Inject 2 quarts per 1 inch of trunk diameter (d.b.h.) Make one hole (two quarts per hole) per inch of trunk d.b.h. Apply to a depth of 6 to 12 inches in a circle around the host tree. Holes should be spaced approximately 36 inches apart. A second circle may be necessary and can be applied outward from the first one. As a rule the first circle will be about three feet from the trunk and for larger trees, the second circle will be out another three feet from the first one or six feet from the

trunk. For trees less than two inches d.b.h., make a minimum of four injections around the plant.

In certain soil types or where compaction has occurred, application of 2 quarts of treatment mixture per hole may result in treatment mixture bubbling up to the surface and, thus, increased exposure to the public and environment. When this occurs, the applicator can apply 1 quart of mixture per hole and double the number of holes per inch of d.b.h.

It is very critical that the material injected into each hole overlap with that injected into the adjacent hole. The use of moderate pressure will force the material out to approximately 1.5 to 2.0 feet in radius from the injection hole and aid in the overlap in moist soils. The material should not be applied if soil conditions are dry. If dry soil conditions exist, soil under the tree should be irrigated. At the time of notification of treatment, residents and landowners should be encouraged to water the soil under the trees prior to treatment to help increase the effectiveness of the treatment. These application pattern instructions are important to ensure even distribution of the Merit solution around the plant for uptake throughout the tree.

Immediately after treatment, a pesticide treatment sign must be placed at each treated tree and stay in place for 24 hours. Soil injection treatments can take place throughout the daylight hours. Trees that are not suitable for soil treatment (too much blacktop or cement surrounding the tree trunk) will receive the Mauget treatment.

Soil Injection Calibration (power equipment):

Prior to any treatments, the equipment will be calibrated with water to determine proper delivery of the amount of material needed per hole.

1. Ensure equipment is in good operating condition. Remove all screens from the system. The WP formulation will clog screens.

2. Fill the spray tank with clean water.

3. Determine how much solution you want to add to each injection hole. The volume per injection may need to be varied due to soil type and condition, but 2 quarts of solution per injection hole is recommended. If the amount of solution is decreased from 2 quarts per hole, the amount of Merit must remain constant at 1.89 grams of formulation per inch of d.b.h..

4. Start up the sprayer and collect water into a container. Time how many seconds it takes to deliver injection volume determined in Step 3.

5. Repeat Step 4 at least three times at the same pressure and with the same injector probe. Take an average of the recorded delivery times to produce the desired amount.

Thus, by counting the number of seconds (as determined in Step 5) during application, you can deliver an approximate amount of solution per injection site. The amount delivered into the soil may be less than calibrated because the soil restricts the flow rate out the injector tip. Loose and sandy soils accept injection flow better than heavy soils. A more accurate method to monitor the amount of material injected into the soil can be achieved by using a flow meter at the control valve on the injector probe.

To maintain uniform application of the proper amount of treatment mixture, applicators should periodically check vent holes in the injector and clean any holes that become clogged with soil.

Advantages:

1. Once applied the treatment is complete. The treated tree does not have to be monitored for a period of time as with the Mauget application method.
2. More active material and volume available to move into the tree.
3. May get extended activity beyond one season of adult activity.
4. The material and technique are presently used by a number of tree companies to control other insects and are well accepted in most states.
5. The material is registered for use on a number of fruits and vegetables and has food tolerances.
6. The material does not move much in the soil.

Disadvantages:

1. The application and required equipment are highly visible and will attract the attention of the public.
2. Concern about contaminating ground water.
3. Some urban trees have hard surfaces over the root zone and drip line.
4. The cost of the treatment is estimated to be between $6.00 and $12.00 per inch of d.b.h.

b. Mauget trunk injection: Use Imicide capsules with the Mauget trunk micro-injection system to treat urban and rural trees as needed. The 4 ml capsules will contain a 10% formulation of imidacloprid and will be applied at the rate of one capsule per two inches of d.b.h.

Determine the number of Mauget's to use per tree by determining the trees d.b.h. and dividing by 2. A tree with a d.b.h. of 20 inches would require 10 Mauget

dispensers.

The dispensers should be placed in the root flares close to the soil (2 to 6 inches above the soil-wood line). It is very important not to place the dispensers in valleys as poor distribution of the material will occur.

Once the tree d.b.h. has been determined, place the dispensers on the ground around the tree in the root flare areas that will result in the best distribution of the material throughout the tree. If necessary more than one dispenser can be placed in one root flare area. Then activate the dispenser by hitting the top with a rubber mallet or by pressing between the hands. Using a battery operated drill with a 11/64 or 3/16 bit, drill a hole approximately 0.5 to .75 inches deep on a 45 degree angle to the main trunk where each dispenser is to be placed. The hole should extend just into the tree xylem area. Then insert the dispenser tube firmly into the micro injection unit and seat snugly into the hole in the tree. Tap the barrel section lightly with a rubber mallet to firmly seat the micro injection unit in the hole. You should hear a popping sound if the unit is properly in place.

If not installed correctly, the material will not go into the tree and may possibly leak and cause environmental contamination.

Once treated a sufficient amount of time is allowed for the material to empty out of the micro injection unit and into the tree. This can vary depending on the time of the year, weather conditions, and tree species. Moist soil conditions facilitates the emptying of the micro injection units. At the time of notification of treatment, residents and landowners should be encouraged to water the soil under the trees prior to treatment to help increase the effectiveness of the treatment.

The time required for complete dispersion of the material into the tree will vary from ½ hour to over four hours. The micro injector units will remain on the treated trees for a maximum of 4 hours. If empty before 4 hours, they can be removed from the tree. If a unit or units have not emptied at the end of a four hour period, remove the unit(s) and note on the daily report the location of the tree and the approximate % of material remaining in each capsule. Time applications so that all Mauget's are removed before dark. Once empty the unit and dispersal tube are removed from the tree and properly disposed of according to the label instructions.

Personnel must be trained by the J.J. Mauget Company or one of their epresentatives before they attempt to do this type of treatment.

Advantages:

1 Can get the material (imidacloprid) up into the tree in a short period of time (1-3 weeks).
2 Can treat urban trees that have hard surfaces over the root area and drip line.

3 No water needed little equipment to move around.
4 Is registered for use in most states.

Disadvantages:

1. Its use can possibly damage trees that are treated because a number of small holes need to be drilled into each tree.
2. After micro injectors are inserted it takes a period of time for the pesticide to leave the injector and go into the tree. In an urban area the injectors would have to be monitored until such time that they can removed.
3. If not applied correctly, uniform coverage may not occur throughout the tree.
4. Treatment window is smaller and closer to ALB emergence and flight.
5. Trees less than two inches in diameter cannot be treated with the Mauget system.

2. Bark sprays:

Bark sprays target the adult beetles as they feed on the twigs and deposit eggs during the adult emergence and flight period. Thorough coverage of the bark is required, therefore apply material with a hydraulic type sprayer with pressure (400-800 psi). Bark sprays may be used during the adult emergence and flight period : 1) on individually infested trees prior to removal to prevent any adults that may be present from dispersing, or 2) on large tracts of wooded land surrounding infested trees to quickly suppress populations or protect from infestation.

There are a number of pesticides that have been tested for their contact and stomach effect on adult beetles when applied as bark sprays. Tests in China and the United States indicate that a number of registered pesticides are effective against the adult beetles when applied as bark sprays in the laboratory.

Recommended bark sprays are in the following order of priority:

Chemical: Astro (Permithrin) 36.8% (3.2 lbs. ai per gallon)

Astro, from FMC Corporation, can be mixed with water and used as a bark spray with hydraulic spray equipment using 4 fluid ounces of formulation in 100 gallons of water. There should be good agitation in the mixing tank and the material should be applied so that all tree bark is covered with the material. Major emphasis should be on good coverage of bark in the upper 2/3 of the tree, including twigs 0.25 to 0.75 inches in diameter. The applicator should try to prevent the spray material from going onto the ground if possible. It may be advisable to use a good agricultural sticker with the spray mix to keep the material on the bark when exposed to rainfall. Do not apply the spray if rain is expected within 6 hours of spraying and do not apply to wet bark. Do not apply when wind speed and/or

direction favors drift beyond the area intended for treatment.Repeat applications may be made but do not apply more than 2.0 lbs. per acre per year.

Chemical: All Pro Dursban 4E (chlorpyrifos)(4 lbs. ai per gallon)
Dursban 4E, from DowElanco, can be mixed with water and used as a bark spray with hydraulic spray equipment using 8 fluid ounces of formulation in 100 gallons of water. Applications can be repeated at 7 to10 day intervals if needed. Follow instructions as they relate to the treatment of Astro.

Chemical: Talstar Lawn and Turf (Bifenthrin) (2/3 lbs. ai per gallon)

Talstar L&T, from FMC, can be mixed with water and used as a bark spray with hydraulic equipment using 0.1 fluid ounces of formulation in 100 gallons of water. Additional applications can be made to the trees during the adult flight period but the total amount applied should not exceed 4.0 fluid ounces per 4,356 square feet of ground area. Follow instructions as they relate to Astro.

Chemical: DeltaGuard T&O (Deltamethrin) (0.42 lbs. ai per gallon

DeltaGuard T&O, from AgrEvo EH, can be mixed with water and used as a bark spray with hydraulic spray equipment using 1.0 fluid ounces of formulation in 100 gallons of water. Follow instructions as they relate to the treatment with Astro.

When applying pesticides phytotoxicity (damage to the target plant) can occur and should be checked on a limited number (1-3 plants per species) of specimens before treating large numbers of trees. The various species can react differently to the pesticide.

Before using any pesticide always read the entire label and follow all instructions. Make sure the material is registered for your specific use in the area where you plan to treat. Make sure all human and animal safety guidelines are strictly followed. Dispose of any empty containers as per label instructions.

D. Data collection:

When ALB infested host material is treated or removed the following data will be recorded:

1. Date and time of treatment
2. Type of treatment (Mauget, Soil Treatment, Bark Spray)
3. Amount of chemical applied.
4. Location of host material, either street address or GPS coordinates.
5. Host Species.
6. DBH of host species.

7. Ownership of host treated or removed, private or public. If private ownership, the name, address, and phone number of the owner will be documented.
8. Contractor conducting the treatment or removal.
9. Temperature.
10. Weather conditions
11. Name of inspector supervising treatment.

VI. PUBLIC OUTREACH

An effective Public Outreach Program is essential to the success of an ALB eradication program. An informed and supportive public will serve as the best survey tool available to the program as new ALB sights have repeatedly been identified and reported by the general public in New York and Chicago.

A. Public Meetings

Public meetings should be scheduled in the impacted communities as soon as possible after ALB has been confirmed. The purpose of these meetings is to inform the public of the need and plans for an eradication and quarantine program in order to secure their support or minimize opposition. Prior to the meeting, any specific political, social economic, and environmental concerns of the community should be identified.

Public meeting notifications at a minimum should be posted in the local news media. If possible, direct mailings to the residents of the impacted community should be conducted.

The public meetings should include the following:

1. A moderator who can insure orderly conduct of the meeting, and direct questions to the appropriate persons for answers.
2. Political representatives who are familiar with local concerns.
3. Representatives from State Regulatory Agencies who can answer questions about the detection of ALB, quarantine restrictions, control measures, and their impact.
4. Representatives from state and local universities who can answer questions about the biology of ALB, its host range, and potential impact in theUnited States.
5. Representatives from PPQ, and all federal, state, county, city and local cooperators to answer questions about their role in the upcoming eradication and quarantine program.
6. Adequate informational material (handouts, fact sheets, informational posters, etc.) should be readily available at the meeting.

Public meeting sites should be centrally located within the impacted community. They should be well ventilated, have adequate seating, electrical outlets, lighting, and audio equipment.

Additional meetings for small groups with specific concerns can be scheduled after public

meetings have been held. These meetings are generally attended by representatives from the cooperating agencies directly involved in the ALB eradication program. The intent of these meetings is to address the specific needs of these groups.

B. Phone Banks

A toll-free telephone number will be set up to serve as an ALB hot line. The hot line number is staffed by personnel trained to answer questions from the public about the ALB eradication program. Written material is provided for anticipated common questions, and details the history and protocols of the project as well as the biology of ALB. Forms will be developed locally to document complaints, threats and sightings of ALB. Past experience has shown that three to five individuals on staggered shifts between 7:00 a.m. to 7:00 p.m. can handle calls from a community of 30,000. In large metropolitan areas, additional staffing may be required to answer calls in a timely manner. When the initial high demand tapers off, staffing can be reduced. A phone answering machine will be installed to take calls after office hours. A questionnaire for use on the Internet should also be developed and placed on the APHIS Web Page to allow for the electronic reporting of possible ALB positive sites.

C. Notification

The purpose of notification is to comply with state or local laws and provide accurate information in an understandable and non-threatening format to residents within the regulated area for ALB. Any resident who will have ALB-positive host material removed from their property will be notified in writing prior to the removal being conducted. These notices will include the ALB hot line number and the opportunity for the property owner to witness the removal of ALB-positive host material if they desire to do so.

Notification can be accomplished by direct mailing or door-to-door contact. Staff conducting notifications should avoid the following:

1. Negative or facetious comments about the project.
2. Misinformation about regulatory and control protocols.
3. Speculation about the progress of control measures.
4. Special arrangements with individual property owners.

All questions are referred to the ALB hot line number.

VII. MEDIA RELATIONS

The APHIS, PPQ, and LPA staff should be notified as soon as possible after ALB is confirmed and routinely notified of any media requests. All national media calls must coordinated with APHIS/LPA.

One primary media spokesperson should be designated for the cooperative eradication program.

The spokesperson is to be thoroughly briefed and current on particular aspects of the program such as control, regulatory, and survey activities.

Creating a rapport with local media people results in more accurate and favorable coverage of the project. To avoid conflicting and confusing statements, all outgoing information should be processed through the designated spokesperson.

The amount of media attention given to ALB eradication programs in the past has been very high. If personnel at the local level do not have adequate media experience to deal with the requests, the APHIS, PPQ, and LPA staff should be notified so they can provide experienced media representation to the program.

VIII. COOPERATIVE RELATIONS

It is essential that PPQ notify all of the primary cooperators of the ALB infestation prior to making a public announcement. This will include City, County and other local governments as well as our traditional Federal and State Cooperators. Additionally, all of the cooperating parties should hold orientation and programmatic meetings to clearly establish their roles in the pending ALB eradication program prior to holding public meetings an dealing with the media.

The examples listed below are based on the cooperative ALB eradication programs in New York and Chicago. The actual roles taken on by cooperators in the program will vary by location.

USDA/APHIS/PPQ-Survey, Regulatory, Control, Media Relations and Public Outreach.

State Departments of Agriculture-Survey, Regulatory, Control, Media Relations, and Public Outreach.

City/LocalGovernments-Media Relations, Public Outreach, Tree Removal and Replanting
Some city/local governments have provided office space and date entry during program startup.

USDA Forest Service- Tree planting, program assistance and Tree Climbers.

A. Primary Cooperators

Primary Cooperators include:

1. APHIS: PPQ and Otis Methods Development
2. USDA Forest Service: State and Private Forestry, Urban and Community Forestry, and Forest Health Protection.

3. State Government: State Plant Regulatory Agency/State Department of Agriculture, State Forestry, State Natural Resource Agencies, State Urban Forestry Agencies, State Environmental Departments, Department of Transportation and Highway Patrol.
4. Local and City Government: City or County Forester, County Cooperative Extension Service, Mayor or City Manager, City Engineering, Transportation, Parks and Sanitation Departments, City or County Commissioners, City Police and County Sheriff Offices.
5. State Universities and Colleges: These entities can assist with Education and provide technical expertise.

B. Secondary Cooperators

Secondary Cooperators include:

1. State Chapter of Arboriculture.
2. Home Owner Associations.
3. Birding/Omithological Groups.
4. Telephone and Electrical Companies.
5. Environmental/Forestry Groups.

Cooperative eradication programs are traditionally a 50/50 cost share between APHIS, PPQ and the primary cooperators involved. PPQ traditionally supplies 50% of the funding with the additional 50% of the costs funded or provided by in kind contributions from the cooperating parties.

APPENDIX
Asian Longhorned Beetle Host Trees Found in North American Infestations and Chinese Literature Citations
V.C. Mastro

Tree Specíes	*Common Name*	*Exit Holes in US Trees (E) or from Literature(L)*	*Site*	*Host Rating*
1 Acer *spp.*	maples	L	China	
A. negundo	boxelder maple	E	A, B, R	H
A. nigrum	black maple	E	A, B, R	H
A. platanoides	Norway maple	E	A,B,Q,R,S,Ad	H
A. *pseudoplatanus*	sycamore maple	E	B, Q, R	H
A. rubrum	red maple	E	A,B,Q,R,S,Ad	H
A. saccharinum	silver maple	E	A, B, Q, R	H
A. *saccharum*	sugar maple	E	A, B, Q, R	H
2 *Aesculus glabra*	Ohio buckeye	E	R	H
A. Hippocastanum	horse chestnut	E	A,B,Q	H
3 Albizia (Albizzia)	silk tree	E	A	M
Julibrissin				
4 Betula populifolia	gray birch	E	A	H M
5 Elaeagnus angustifolia	Russian olive	L	China	M
6 *Fraxinus pennsylvanica*	green ash	E	R	M
F. excelsior	European ash	E	R	M
7 Hibiscus syriacus	Rose-of-Sharon	E	A	M
8 Melia spp	mahogany	L	China	?
9 Morus spp	mulberry	L	China	L
10 Populus spp.	poplars	L		
P. alba	white poplar	E	China	H
P. Tremuloides	quaking aspen	E	A	H-M
11 Prunus spp.	cherry,peach,plum	L	China	?
12 *Pyrus spp.*	pear	L	China	?
13 Salix spp	willow	L	China	H
S. babylonica	weeping	E	A,B	H
S. fragilis	crack willow	?	Ad?	H
S. nigra	black willow	?	Ad?	H
14 Ulmus spp	elms	L	China	H-M
U. americana	American elm	E	B,R	H
U. parulfolia	Chinese elm	L	China	H
U. procera	English elm	L	China	H-M
U. Pumila	Siberiean elm	E	R	H-M

A = Amityville, NY Q = Queens (Bayside), NY S=Summit, IL R = Ravenswood, IL B = Brooklyn (Greenpoint), NY
Ad = Addison, I

APPENDIX 2
INTENSIVE CORE & DELIMITING SURVEY PROTOCOLS

APPENDIX 3
RECONNENDED EQUIPMENT

1. Bucket Trucks. Two person Bucket Trucks should be used initially in the program. These trucks have the capability to lift two individuals at a time in the bucket so that experienced survey personnel can train bucket operators in the identification of ALB damage to host trees.

2. Tree Chippers: At a minimum, a standard 11- or 12-foot tub grinder should be used for the project. This equipment can process an adequate amount of material to provide for timely destruction of regulated articles. If a high percentage of large trees in excess of 25 inches DBH are found to be infested, a 14-foot tub grinder with the capacity to chip wood at rate up to 400 cubic yards or 75 to 100 tons per hour are recommended.

3. Data Loggers/GPS Units currently being tested by Otis Methods Development include:
   A. Hammerhead P-233
   B. LaserLite Pro
   C. March II GPS receivers/data loggers.

Once evaluation is complete a recommendation will be forth coming from Otis on which of these unite best fits the needs of an ALB eradication program.

APPENDIX 4
HOST TREE IDENTIFICATION AIDS

1. *Audubon Society Field Guide To North American Trees*. Eastern or Western Addition. Elbert Luther Little, Sonja Bullaty (Photographer), Angelo Lomeo (Photographer), June 1998.

2. A *First Guide To Trees*. Publisher: George A. Petrides, Roger Tory Peterson/ Paperback/ Houghton Mifflin Company/ May 1998.

3. *Tree Finder*. A Manual for the Identification of Trees by their Leaves. May Theilgaard Watts/ Paperback/ Publisher Nature Study Guild January 1998.

4. *Simon & Schuster Guide to Trees*. Mariella Pizzettii, Paola Lanzara, Stanley Schuler (Editor)/ Paperback/ Simon & Schuster Trade/April 1978.

5. *The Tree Identification Book*. George W. D. Symonds, Stephen V. Chelminski (Photographer) /Paperback/ Morrow,William & Co./ December 1972.

APPENDIX 5
COMPLIANCE AGREEMENT

1. Name and Mailing Address 2. Location

3. Regulated Articles:
   A. The Asian Longhorned Beetle (*Anoplophora glagripennis)* in any living stage of development.

   B. Firewood (all hardwood species) and all host material living, dead cut or fallen, inclusive of nursery stock, logs green lumber, stumps, roots, branches and debris a half-inch or more in diameter of the following genera: Acer (Maple); Aesculus (Horse Chestnut); Malus (Apple); Melia (Chinabery); Morus (Mulberry); Populus (Popular); Prunus (Cherry); Pyrus (Pear); Robina (Locust); Salix (Willow); Ulmus (Elm); Batula (Birch); Hibiscus (Rose of Sharon); Fraxinus (Ash) and Citrus are regulated.

   C. Any other article, product, or means of conveyance when it is determined by the inspector that it presents the risk of spread of the Asian Longhorned Beetle in any stage of development.

4. Applicable State or Federal Cooperative Domestic Quarantines.

5. I/We agree that in authorizing and participating in these treatments as a basis for the certification of regulated articles, no liability shall be attached either to the State Department of Agriculture or to any of its employees in the event of injury to property or the regulated articles; to handle process and move regulated articles in accordance with the provisions of applicable plant quarantines; to use all permits and certificates in accordance with instructions; to maintain and offer for inspection such records as may be required; to carry out all additional conditions, treatments, precautions, and sanitary measures which may be required by the inspector in the following stipulations:

   A. All nursery stock or live plants of regulated species held or originating in a quarantine area must be inspected and certified by an Officer/Cooperator and accompanied by a copy of the Compliance Agreement and the certificate of inspection.

   B. No firewood may be moved out of the quarantine area.

C. No dead, cut, or fallen logs, green lumber, stumps roots, branches and debris of ½ inch or more in diameter of regulated species may be removed from quarantines areas unless chipped to a ½-inch size (chips) or less.

D. All D stumps must be ground to nine inches (9) below the soil surface and covered with soil.

APPENDIX 5
CONTINUED

E. A copy of this Compliance Agreement must accompany all regulated articles including chipped wood being moved out of the quarantine area.

F. All signs and symptoms of the Asian Longhorned Beetle must be reported to the State Department of Agriculture at XXX-XXX-XXXX.

Signature: Title: Date:

Agreement # ALB-

Inspectors Signature:

State Agency Official (Name and Title) Address:

APPENDIX 6
WHAT TO LOOK FOR

This appendix will contain color photos of ALB life stages and damage. Please look at the following Web Site for the type of photos to be used.

http://willow.ncfes.umn.edu/albpestalert/

REFERENCES

1. Peng, J. and Liu Y. 1992. *Iconography of Forest Insects In Hunan China*. Hunan Forestry Department/Institute of Zoology, Academia Sinica.

2. USDA APHIS PPQ New Pest Advisory Group (NPAG) Report 1996.

CONTRIBUTORS

USDA-APHIS-PPQ:

NEW YORK: Mike Wright, State Plant Health Director, Jonathan Staples, State Operational Support Officer, Joe Gittleman, ALB Project Supervisor.

ILLINOIS: Ken Kruse, State Plant Health Director, Joe Schafer, ALB Project Supervisor.

Otis Methods Development, Vic Mastro Center Director, Alan Sawyer Entomologist

State Departments of Agriculture:

NEW YORK: Robert Mungari, Director Division of Plant Industry New York Department of Agriculture and Markets.

ILLINOIS: Stanley Smith, Nursery Manager Illinois Department of Agriculture.